



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Northwest and Alaska Fisheries Center
Resource Assessment and Conservation
Engineering
2725 Montlake Boulevard East
Seattle, Washington 98112

November 15, 1982

CRUISE RESULTS

Cruise No. CH-82-03 NOAA R/V CHAPMAN

Cruise No. CH-82-01 Chartered Vessel PAT SAN MARIE

Cruise Period

NOAA R/V CHAPMAN June 2-July 16

Chartered Vessel PAT SAN MARIE May 26-August 9

Itinerary

The NOAA research vessel CHAPMAN departed Dutch Harbor June 2 and returned to Kodiak on July 16 upon completion of its portion of the 1982 eastern Bering Sea Crab/Groundfish survey. An intervening port call was made on June 22 at Dutch Harbor to load equipment and exchange scientific personnel. A total of 2 sea days were lost to bad weather, 8 days in transit, and 31 days conducting fishing operations.

The chartered fishing vessel PAT SAN MARIE departed Kodiak May 27 and returned to Kodiak on August 9 upon completion of the 1982 eastern Bering Sea Crab/Groundfish survey. Port calls were made to Dutch Harbor on June 4 for repairs and June 22, July 15, and August 4 to load equipment and exchange scientific personnel. A port of call was made at St. Paul Island on July 7 to disembark a member of the scientific party. A total of 2 sea days were lost to bad weather; 16 days were spent in port, of which 9 days were due to vessel repairs; 13 days were spent in transit; and 44 days were spent conducting fishing operations.

Area Surveyed

The area surveyed by the CHAPMAN and PAT SAN MARIE extended northward from Unimak Pass to approximately 61°40' N latitude and east from approximately 178°00' E longitude, along the 100 fm contour and east to the Alaska mainland.



Primary Objectives

The primary objectives of this survey were to:

1. continue the annual series of demersal trawl assessment surveys of crab and groundfish in the eastern Bering Sea;
2. collect biological information on crab and groundfish species in the slope and shelf waters east of the U.S.-U.S.S.R. Convention Line;
3. collect water temperature data using XBT's and bucket thermometers;
4. conduct alternate row fishing experiments between NWAFC survey vessels to calculate relative fishing power coefficients; and
5. conduct side-by-side comparative fishing studies between the PAT SAN MARIE, the Japanese Fisheries Agency research vessel RYUJIN MARU NO. 8, and the TINRO research vessel SRTM-8459 to establish relative fishing efficiencies.

Secondary Objectives

Other objectives were to:

1. collect samples of fish and invertebrate for the University of Washington and other institutions,
2. photograph fish and invertebrate species of interest,
3. collect and preserve stomach contents of pollock and conduct stomach scans of other predator species for food habit studies, and
4. collect trawl gear performance information with hydroacoustic mensuration instruments.

Gear

The modified 83-112 Otter trawl was used at all survey stations occupied by the CHAPMAN and PAT SAN MARIE (Figure 1). It had a 112' footrope and 83' headrope with 4" mesh in the wings and body, and 3 1/2" mesh in the intermediate and codend with 1 1/2" mesh codend liner. There were 41 floats on the headrope. The mean effective path width was 54.64 feet on the CHAPMAN and 53.56 feet on the PAT SAN MARIE, as measured by gear mensuration equipment. The mean vertical opening was 7.5 feet on both vessels. Six-foot by nine-foot steel V-doors were used by both vessels. The standard 83-112 trawl was modified to enhance bottom-tending characteristics during gear experiments conducted aboard the CHAPMAN prior to the 1982 survey. During previous surveys, the overall dandyline length used with the 83-112 was 40 fathoms on each side, consisting of a single 25-fathom section branching to two 15-fathom bridles. Based on the results of the gear study, 30-fathom double dandylines were used. In

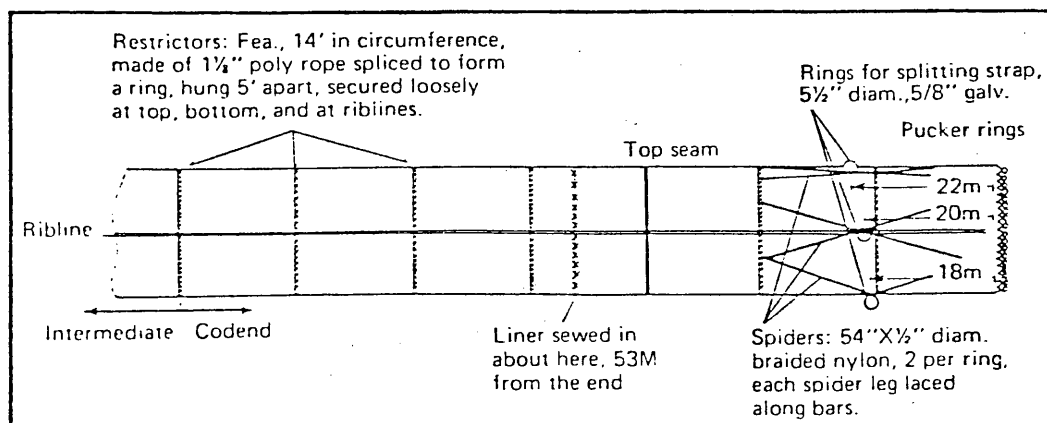
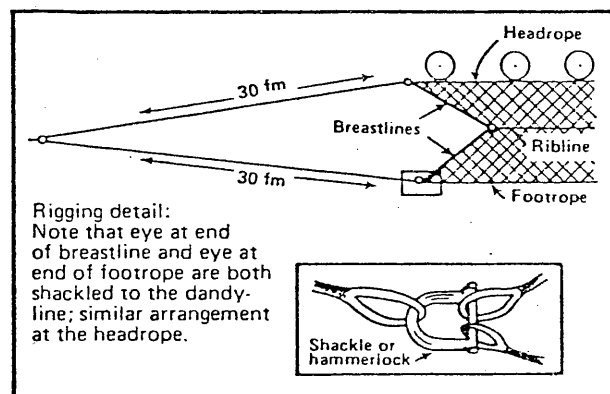
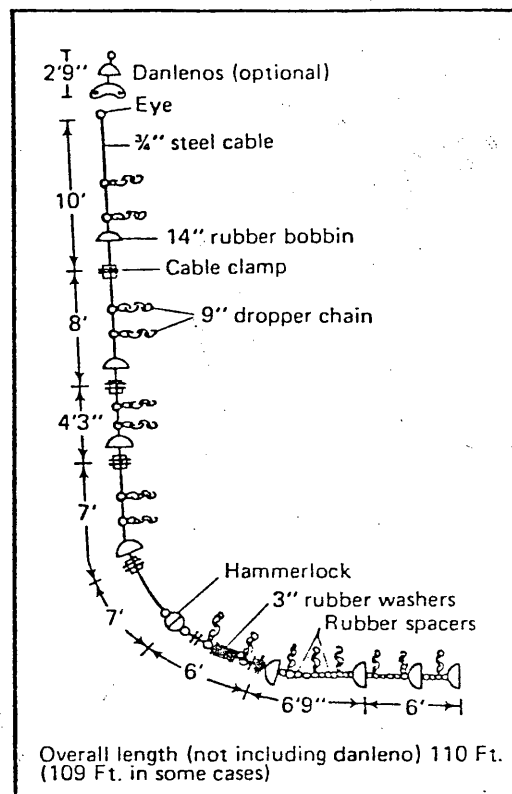
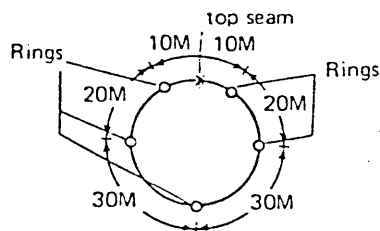
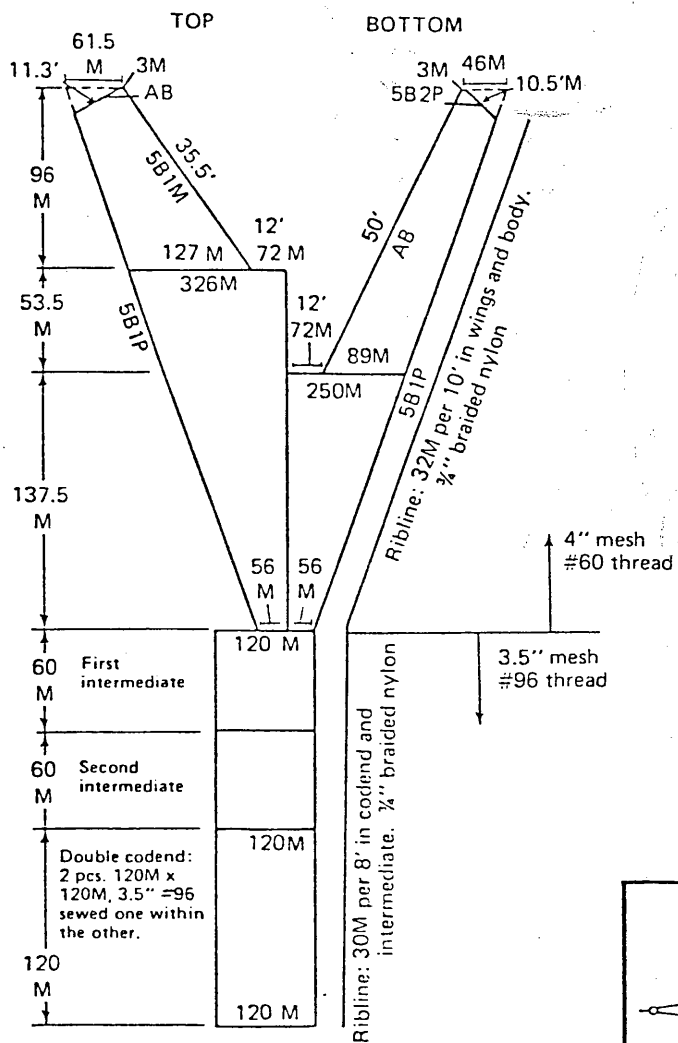


Figure 1.--Diagram of the 83-112 demersal trawl.

addition, 24-inch chain extensions were put between each end of the footrope and lower dandylines to improve bottom contact.

XBT probes were used to obtain water temperature profiles at each station.

Methods

The 1982 eastern Bering Sea survey was a cooperative survey between the NWAFC, Far Seas Fisheries Agency of Japan, and the Soviet Fisheries Agency, TINRO. While the U.S. vessels sampled the waters of the eastern Bering Sea continental shelf, the Japanese vessel sampled the waters of the slope region east of the U.S.-U.S.S.R. Convention Line of 1867, and the Soviet research vessel examined slope waters west of the Convention Line.

Additional time was allocated for cooperative fishing studies to determine relative fishing efficiencies between the NWAFC chartered vessel, PAT SAN MARIE, and the foreign chartered vessels; the No. 8 RYUJIN MARU, a 54.4 meter Japanese landbased trawler; and the Soviet SRTM-8459, a 52.7 meter side trawler. Fishing power correction factors will be applied to the U.S. shelf survey and the Japanese slope survey so that information from both may be incorporated as the results of the 1982 U.S.-Japan cooperative eastern Bering Sea survey. Differences in U.S.-U.S.S.R. fishing powers will be noted, as the results from the Soviet survey in waters north of the 1867 Convention Line on the northwest Bering Sea shelf may also be incorporated in the overall 1982 results.

The U.S. portion of the survey area was delineated, as in previous years, to comprehensively assess the crab and groundfish resources of the eastern Bering Sea. This study region encompasses the major distributional area of commercially important demersal fish and shellfish stocks. Trawling stations were uniformly established on the basis of the standard 20 x 20 mile grid (1 station per 400 nm²) that has been used in earlier Bering Sea surveys (Figure 2).

A 30-minute demersal trawl haul was conducted at each scheduled station and an attempt was made to maintain a constant towing speed of 3 knots. Catches weighing less than approximately 2,400 lb were entirely sorted and processed. Catches weighing more than the 2,500 lb capacity of the sorting table were subsampled. Commercially important crab species were completely removed from every catch. After the catch or subsampled portion of the catch was sorted into baskets, all species or species groups were weighed, enumerated, and either discarded overboard or saved for further processing.

Additional biological data collected on fish species of interest included size frequencies by sex and the collection of age structures. These species included:

Pollock (Theragra chalcogramma)
 Yellowfin sole (Limanda aspera)
 Rock sole (Lepidopsetta bilineata)
 Pacific halibut (Hippoglossus stenolepis)

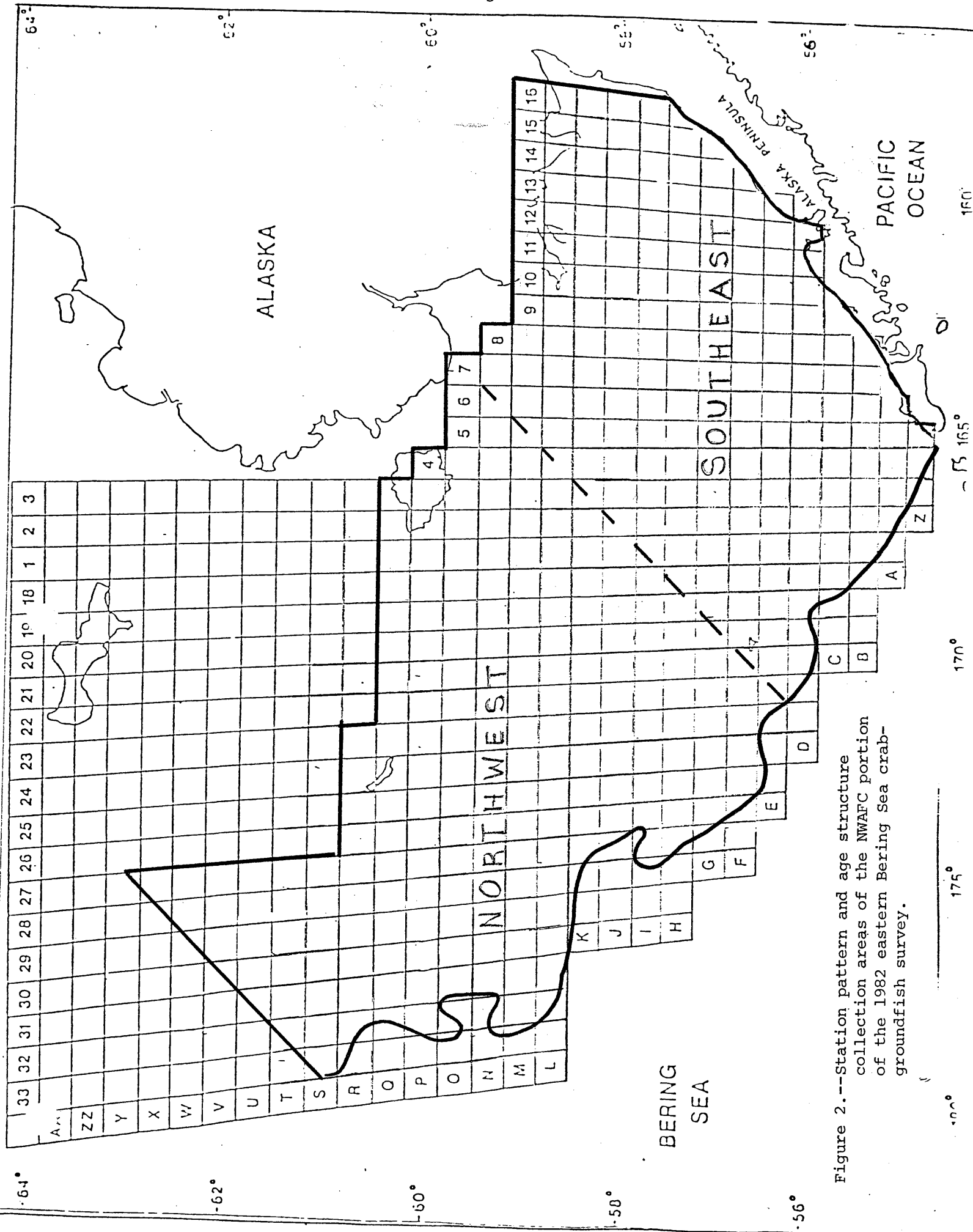


Figure 2.--Station pattern and age structure collection areas of the NWAFC portion of the 1982 eastern Bering Sea crab-groundfish survey.

Pacific cod (Gadus macrocephalus)
 Sablefish (Anaplopoma fimbria)
 Pacific ocean perch (Sebastes alutus)
 Arrowtooth flounder (Ateresthes stomias)
 Alaska plaice (Pleuronectes quadrituberculatus)
 Greenland turbot (Reinhardtius hippoglossoides)
 Flathead sole (Hippoglossoides stenolepis)

Total weights and numbers were determined for king and Tanner crab. All individuals were measured when the crab catch was small. A representative subsample, or approximately 300 crabs, were processed from very large crab catches. In addition to carapace measurements, shell condition, clutch size, and egg condition were also recorded. Tanner crabs were examined for the presence of "blackmat" disease.

Two age structure collection areas (southeast and northwest) were defined to examine differences in year-class and growth rates of selected fish species by region, as shown in Figure 2. Independent samples of age structures were taken in each of the two regions of the survey area. Because there has developed a need to relate survey age data to fishery age data in specific areas of the eastern Bering Sea and because it may be desirable to examine growth at intervals through the survey period, otoliths were stored individually in vials and identified by haul during the 1982 survey.

The objective of the comparative fishing experiments between U.S. vessels was to determine the relative fishing powers of the CHAPMAN and PAT SAN MARIE during the 1982 survey. Each vessel covered a major portion of the survey area transecting alternate north-south columns of standard stations. Relative fishing powers were calculated as the ratio of mean catch rates based on the assumption that each vessel had taken a random sample of stock densities in the common areas fished.

Results

The CHAPMAN and PAT SAN MARIE attempted a total of 367 demersal trawl hauls of which 355 were successfully completed.

During the final portion of the 1982 eastern Bering Sea Crab/Groundfish survey, the PAT SAN MARIE conducted side-by-side comparative trawls with the No. 8 RYUJIN MARU and SRTM-8459 in the northwest outer continental shelf region between 172°30'-176°00' W and 57°00'-62°30' N. Forty-seven hauls were completed by the end of all cooperative fishing operations of which thirty-nine were between the U.S. and Japan, thirty-four between the U.S. and the U.S.S.R., and twenty-six between all three countries. Standard 1982 eastern Bering Sea shelf grid stations were occupied at 39 trawl locations and an additional 8 opportunistic stations were occupied on the upper-continental slope at depths between 76-122 fathoms. These shelf-edge locations were chosen to increase the proportion of the deeper dwelling species (principally Greenland turbot, arrowtooth flounder, sablefish) in each haul so that comparative fishing efficiencies could be examined between each vessel/gear type.

Approximately 133,000 length frequencies by sex/cm category were recorded from 14 fish species (Table 1). Pollock and yellowfin sole combined accounted for about 57% of the total length frequencies taken.

Nearly 5,700 age structures were collected from the overall study region, as shown in Table 2. Otoliths were collected from all designated species, with the exception of Pacific cod from which scale scrape samples were taken.

Approximately 200 pollock stomachs were collected and preserved for subsequent food habit studies. An additional 200 stomachs were scanned and the contents recorded for future analysis.

Yellowfin sole was the most abundantly encountered species in the study region with an overall CPUE value of 72.8 kg/ha trawled (Table 3). Greatest densities were observed in subarea 1 with a CPUE of 165.2 kg/ha. Yellowfin sole were also observed in relatively high concentrations in subareas 4 and 6. Overall, yellowfin sole distribution was generally restricted to the more eastern portion of the survey region at depths ranging from approximately 20-60 fathoms (Figure 3).

Walleye pollock was the second most abundantly encountered fish species with a total CPUE of 58.4 kg/ha. Pollock were encountered throughout the survey region, as shown in Figure 4. CPUE values, by stratum, ranged from 31.9 kg/ha to 47.5 kg/ha in subareas 1-6. Heaviest concentrations were located in subarea 7 (146.8 kg/ha) with the smallest catches made in subarea 10 (11.2 kg/ha).

Similar to pollock, Pacific cod were distributed throughout the study region, although in considerably less concentrations (Figure 5). Highest CPUE value, by stratum, was observed in subarea 3 (40.0 kg/ha) with lowest abundance in subarea 10 (7.9 kg/ha).

Red king crab were generally concentrated in the continental shelf waters of subareas 1 and 6 (Figure 6), while blue king crab formed major aggregations in the region of St. Matthew and the Pribilof Islands (Figure 7). Overall CPUE for red king crab was about 3.0 kg/ha, with blue king crab considerably lower at 0.3 kg/ha trawled.

Distribution of Tanner crab, Chionocetes bairdi and C. opilio, are shown in Figures 8 and 9. C. bairdi were generally restricted to subareas 1, 2, and 7, whereas C. opilio were encountered throughout the region at depths greater than 20 fathoms.

It should be noted that 1982 CPUE values for such bottom-tending species as yellowfin sole, rock sole, flathead sole, Alaska plaice, and Pacific halibut showed a significant increase over abundance in earlier years. Since it is unlikely many of these species are biologically capable of such rapid increases in abundance, part of the increases may be attributed to a change in the standard trawl sampling gear used in 1982.

Table 1.--Groundfish length measurements taken during the 1982 eastern Bering Sea Crab/Groundfish survey.

Species	Number of fish measured
Pollock	40,001
Pacific cod	10,555
Sablefish	31
Arrowtooth and Asiatic flounders	2,592
Greenland turbot	1,228
Pacific halibut	924
Flathead sole	11,115
Yellowfin sole	35,651
Starry flounder	4
Rock sole	16,198
Alaska plaice	13,921
Rex sole	38
Longhead dab	364
Total frequencies	132,622

Table 2.--Age structures^{1/} collected by subarea during the 1982 eastern Bering Sea Crab/Groundfish survey.

Species	Age structures collected by subarea		
	NW area	SE area	Total
Pollock	817	892	1,709
Pacific cod	691	736	1,427
Greenland turbot	299	27	326
Yellowfin sole	155	676	831
Rock sole	51	297	348
Alaska plaice	18	288	306
Arrowtooth flounder	74	175	249
Flathead sole	175	289	464
Total	2,280	3,380	5,660

^{1/} Scales were collected from Pacific cod less than 65 cm, scales and otoliths from cod greater than 65 cm; otoliths were collected from all other species.

Table 3.--Rank order of abundance of the 20 most abundant fish and commercially important crab taxa taken during the Crab/Groundfish survey, 1982.

Rank	Taxon	CPUE (kg/ha) ^{1/}
1	Yellowfin sole	72.8
2	Walleye pollock	58.4
3	Pacific cod	22.2
4	Alaska plaice	14.3
5	Rock sole	13.1
6	Tanner crab (opilio)	8.9
7	Flathead sole	4.5
8	Tanner crab (bairdi)	3.1
9	Red king crab	3.0
10	Longhead dab	2.8
11	Myoxocephalus sp.	2.5
12	Starry skate	2.0
13	Skate unident.	1.6
14	Pacific halibut	1.5
15	Arrowtooth flounder	1.5
16	Sparse toothed lycod	1.5
17	Plain sculpin	1.2
18	Butterfly sculpin	0.9
19	Greenland turbot	0.8
20	Yellow Irish lord	0.8

^{1/} Total effort was 1,473 ha.

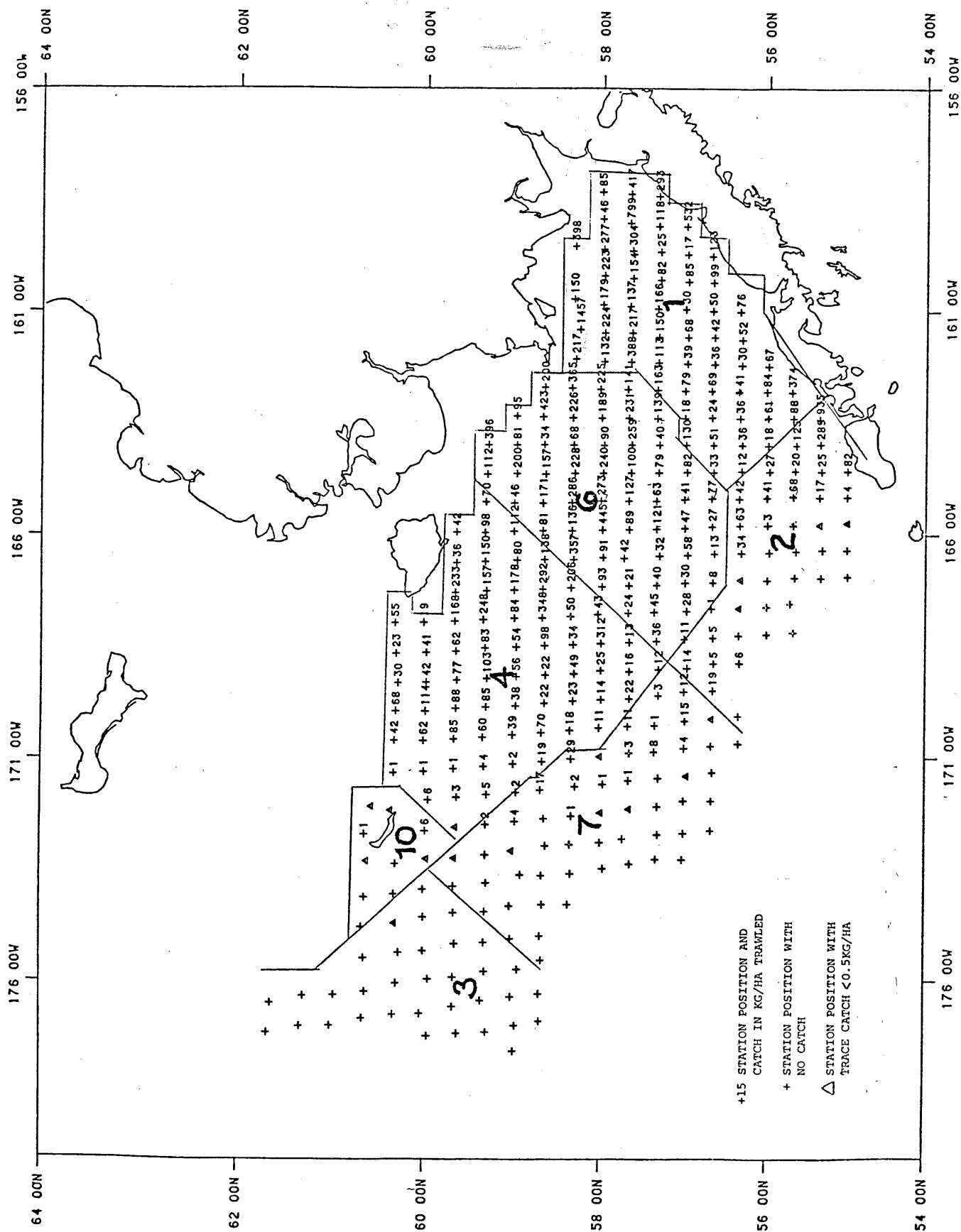


Figure 3.--Catch rates (kg/ha) of yellowfin sole during the 1982 eastern Bering Sea crab-groundfish survey.

Figure 4.--Catch rates (kg/ha) of walleye pollock during the 1982 eastern Bering Sea crab-groundfish survey.

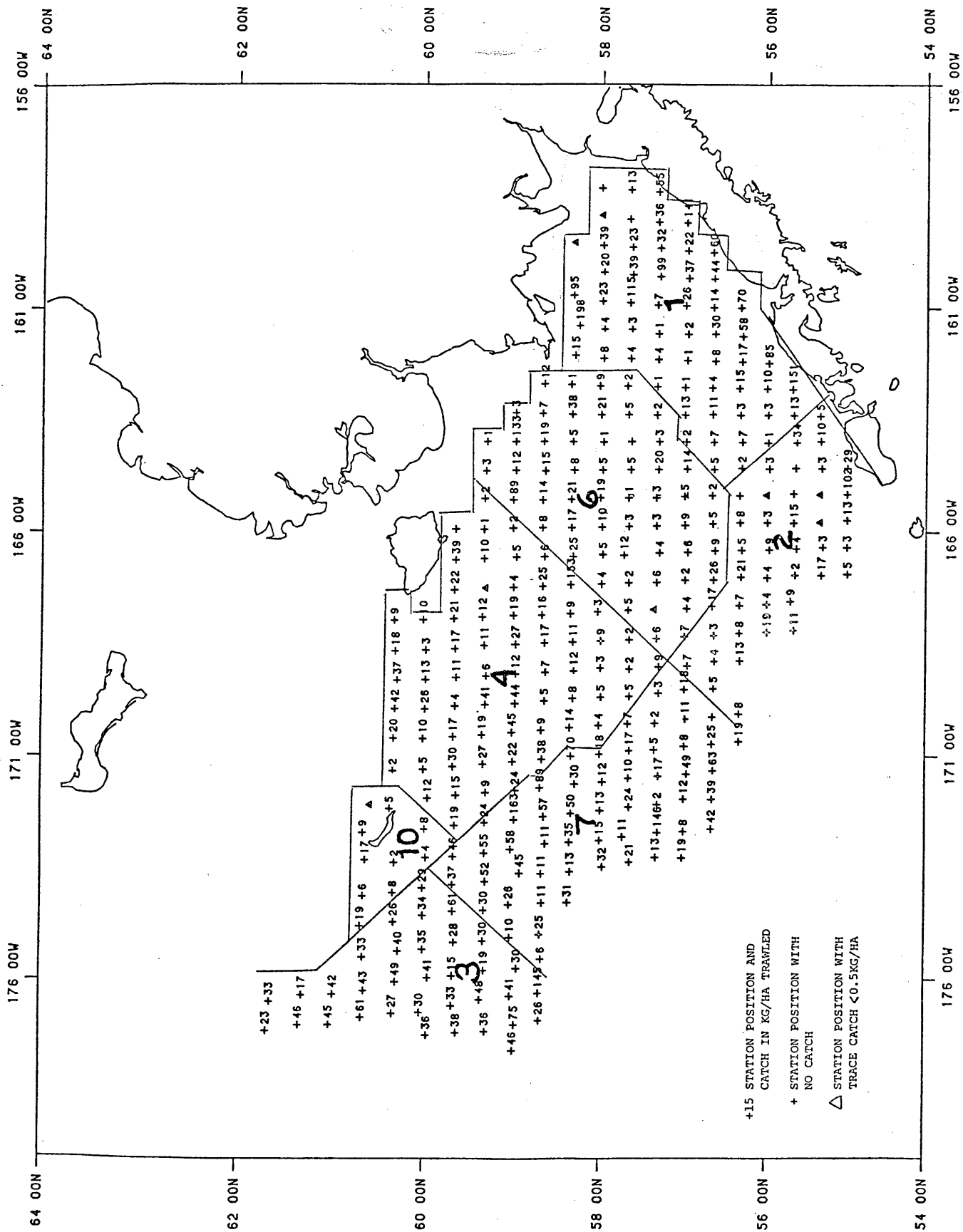


Figure 5.--Catch rates (kg/ha) of Pacific cod during the 1982 eastern Bering Sea crab-groundfish survey.

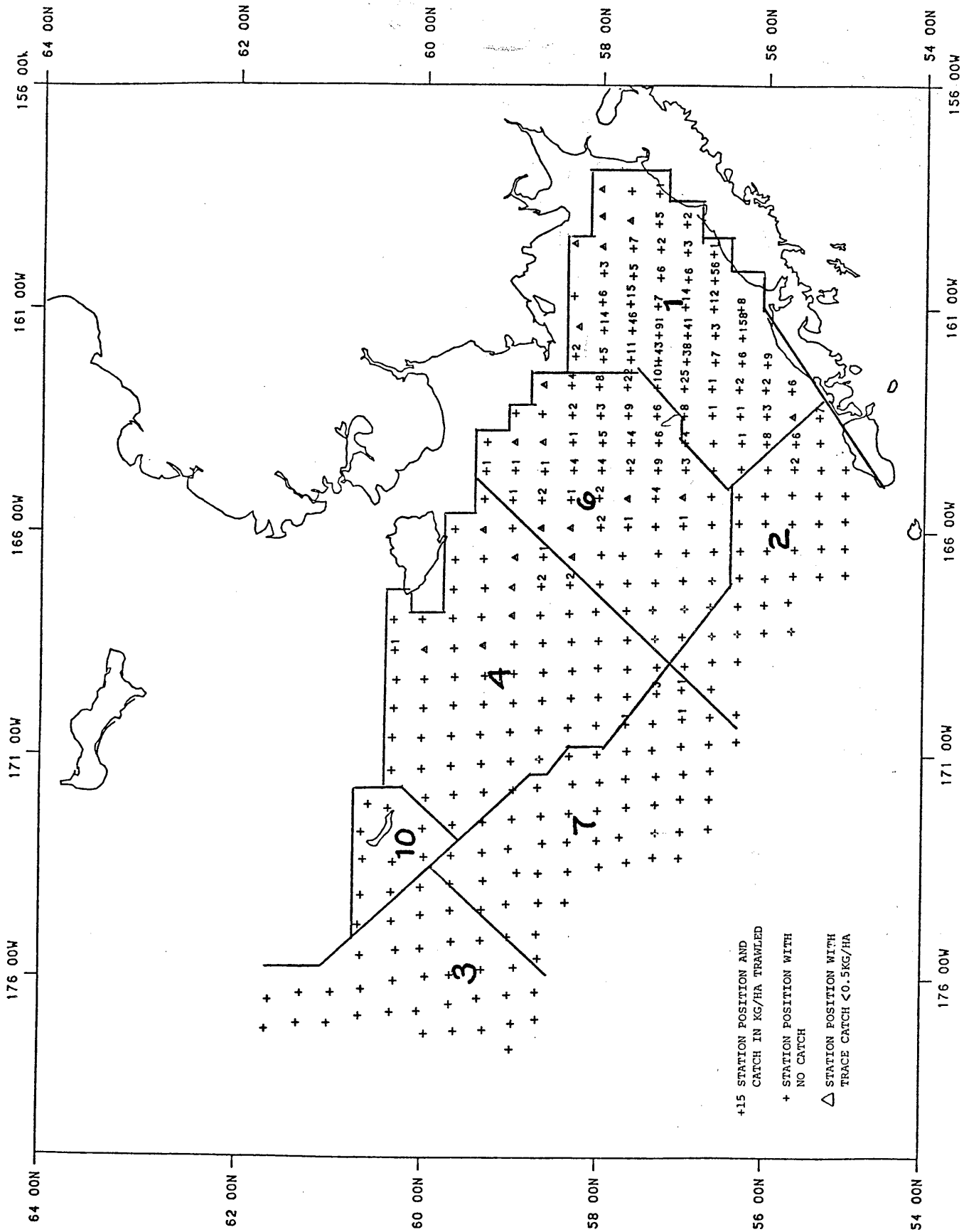


Figure 6.--Catch rates (kg/ha) of red king crab during the 1982 eastern Bering Sea crab-groundfish survey.

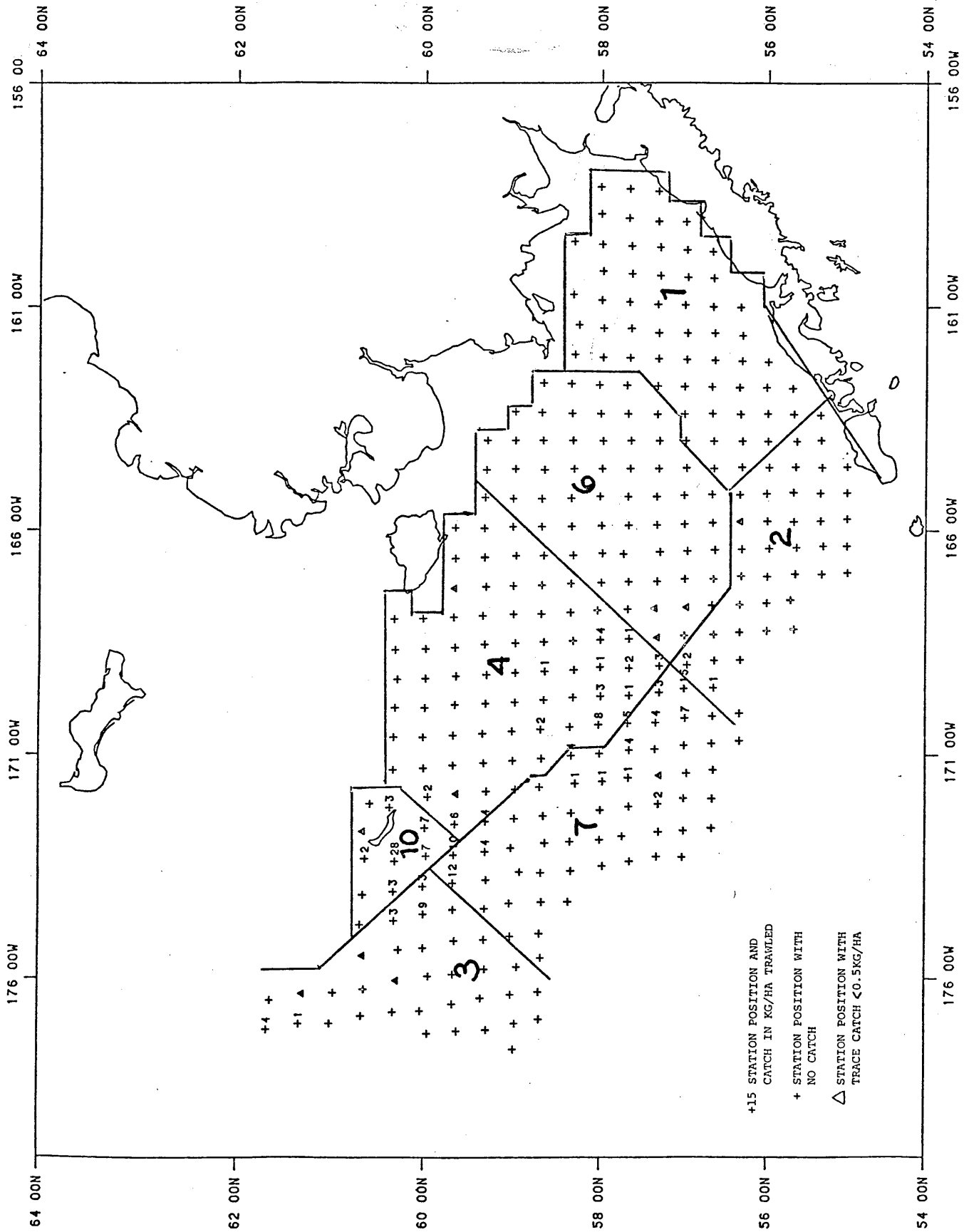


Figure 7.--Catch rates (kg/ha) of blue king crab during the 1982 eastern Bering Sea crab-groundfish survey.

Figure 8.---Catch rates (kg/ha) of Tanner crab, C. opilio, during the 1982 eastern Bering Sea crab-groundfish survey.

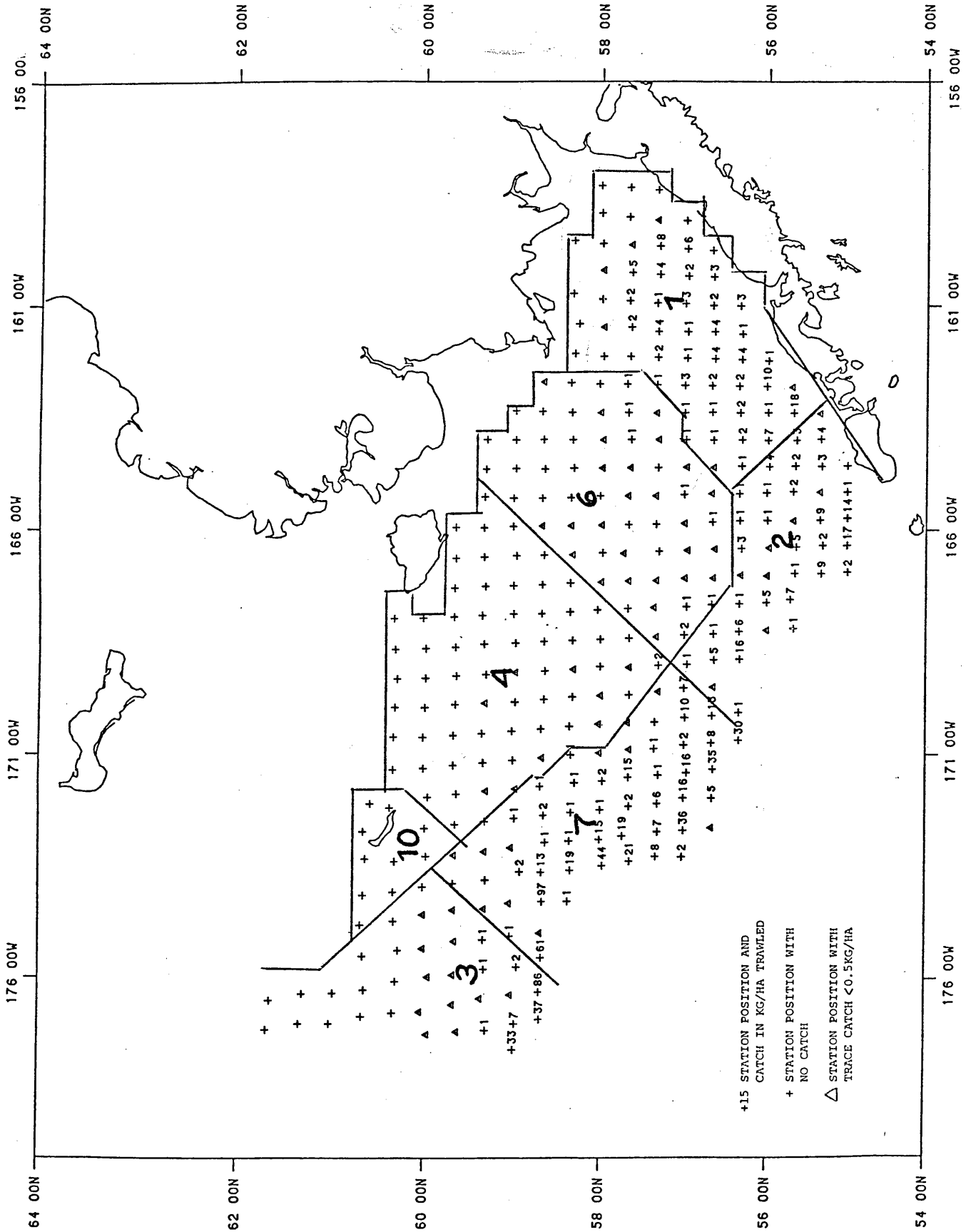


Figure 9.--Catch rates (kg/ha) of Tanner crab, *C. bairdi*, during the 1982 Eastern Bering Sea crab-groundfish survey.

The 400-mesh eastern trawl has been the standard trawl used during eastern Bering Sea surveys prior to 1982, but due to the increasing size of survey vessels in recent years, it has been necessary to adopt a larger trawl. The new standard trawl, with an 83-foot footrope and 112-foot headrope, is a larger version of the 400-mesh eastern trawl. Prior to the beginning of the 1982 survey, gear studies were conducted in the Bering Sea to assure that the new trawl tended bottom properly. As a consequence of these studies, rigging of the 83-112 trawl was modified. General observations during the survey indicated that the new rigging resulted in the trawl having better bottom-tending characteristics based on the amount of demersal debris taken in catches than the 400-mesh eastern trawl. The enhanced bottom-tending efficiencies of the modified trawl gear are currently under evaluation.

Personnel

<u>Leg</u>	<u>Field party chief</u>	<u>Other personnel</u>
<u>R/V CHAPMAN</u>		
1	Allen Shimada (Seattle)	Mike MacPhail (Seattle) Bill Albers (Kodiak) Kristin Stahl (Kodiak)
2	Doyne Kessler (Kodiak)	Terry Sample (Seattle) Franklin Hartsock (Kodiak) Marcelle Van Houten (Seattle)
<u>PAT SAN MARIE</u>		
1	Bob Otto (Kodiak)	Mike Bohle (Seattle) Yuko Umeda (Seattle) Don Fisk (Seattle) Paul Anderson (Kodiak)
2	Jeff June (Seattle)	Sylvia Estrada (Seattle) Ken Weinberg (Seattle) Bill West (Seattle) Therese Armetta (Kodiak) Steve Wilson (Kodiak)
3	Jim Coe (Seattle)	Mike Bohle (Seattle) Karen Halliday (Seattle) Therese Armetta (Kodiak) Eric Monk (Kodiak)

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